IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

#8

In re Patent Application of

JÖRG LAWRENZ-STOLZ

Application No. 09/283,169

Filed: April 1, 1999

For: AN ASSEMBLY FOR FOCUSING AND COUPLING THE RADIATION PRODUCED BY A SEMICONDUCTOR LASER INTO OPTICAL FIBERS

Group Art Unit: 2874

Examiner: H. Sanghavi 6-20-00 T. Flowers

APPEAL BRIEF

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Box AF, Assistant Commissioner for Patents, Washington, DC 20231, on June 8, 2000.

LIMBACH & LIMBACH LLP Date: 06/8/00

By: Kathleen LaBrie

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Assistant Commissioner for Patents
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Sir:

This is a brief for an appeal from a Final Office Action dated February 1, 2000, and from a Notice of Appeal mailed on April 14, 2000. Three copies of this appeal brief are enclosed.

Real Party in Interest

The real party of interest is Coherent, Inc., pursuant to the assignment recorded in the PTO on October March 30, 1998 at reel/frame 9093/0152.

Related Appeals and Interferences

There are no related appeals or interferences.

Status of Claims

Claims 10-18 were originally presented on the filing of the parent application 08/982,018, which is a continuation of 08/047,421 filed on 4/15/93,

now abandoned). The parent has since issued as United States Patent 5,949,932 on September 7, 1999. The present application is a division of the parent application. In a preliminary amendment dated April 1, 1999, claims 11 and 13 were cancelled, and claims 19-21 were newly added. This is an appeal of the rejected claims 10, 12 and 14-21. No other claims are pending or have been cancelled.

Status of Amendments

No amendments or responses were filed subsequent to the final rejection dated February 1, 2000.

Summary of the Invention

The present invention is a laser diode module or light source that includes a laser diode array (1,30) (either individual laser diodes or a single laser diode with multiple emitter regions) for producing individual emissions 12 of laser radiation (page 14, lines 22-29; Figs. 5-6). The emissions 12 are coupled into a corresponding number of respective optical fibers (4, 21) (page 14, lines 22-29; Fig. 6). The optical fibers (4, 21) are supported by a holding means 50 in a side-by-side configuration, with the optical fiber light entrance sides 5 facing the respective laser diode emitters (page 17, lines 25-30). The laser diode array 30 and holding means 50 are adjusted relative to each other and then fastened to a common carrier 70 (page 17, line 30 to page 18, line 3; Fig. 6):

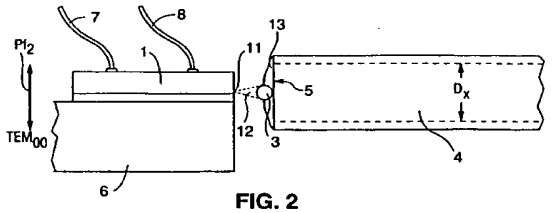


FIG. 2

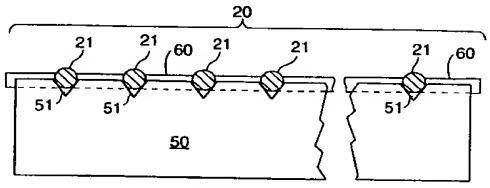


FIG. 4

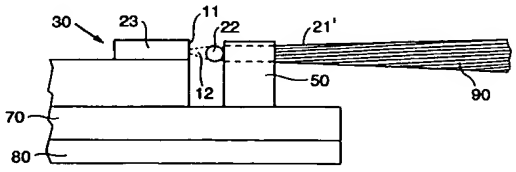


FIG. 6

A single elongated cylindrical lens (3, 22, 60) is glued directly to the light entrance sides 5 of the optical fibers (4, 21) by means of an adhesive 13 (page 13, lines 2-5; page 18, line 26 to page 19, line 3; Figs. 2 and 4) to focus the laser radiation emissions 12 into the respective optical fibers (4, 21) (page 14, lines 1-3). The (bead of) adhesive 13 serves to quasi automatically center the single cylindrical lens 3, 22, 60) across all of the light entrance sides 5 of the individual fibers 4, 21 (page 8, lines 1-3; page 15, lines 25-29; Fig. 2). The lens (3, 22, 60) is not connected to the holder 50. The laser diode module of the present invention provides a simple and reliable alignment scheme between the laser diode array 30 and the individual optical fibers (4, 21).

Issues

The sole issue on appeal is whether claims 10, 12 and 14-18 are unpatentable under 35 U.S.C. §103 over USP 4,147,403 (d'Auria), USP 4,079,404 (Comerford) and USP 4,269,648 (Dakss), and whether claims 19-21 are unpatentable in further view of USP 4,818,062 (Scifres).

Grouping of the Claims

The claims all stand or fall together.

Attachments

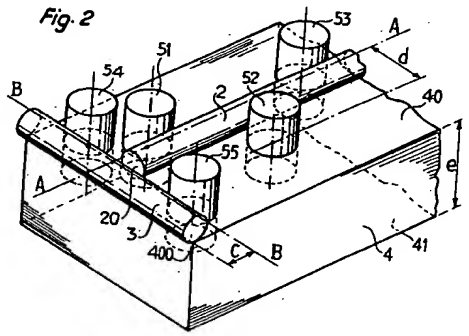
Attached herewith please find an appendix containing the claims involved in the appeal.

Argument

Claims 10, 12 and 14-18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over d'Auria, Comerford and Dakss. Claims 19-21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over d'Auria, Comerford, Dakss and Scifres.

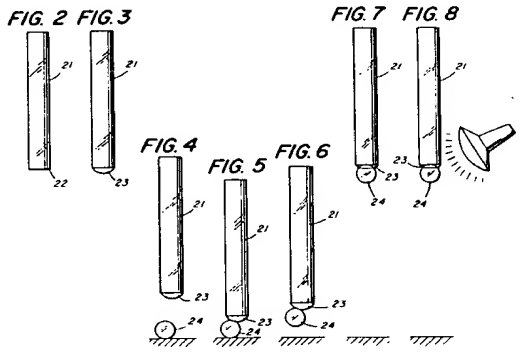
The Prior Art

d'Auria teaches a substrate for positioning the end of one or more optical fibers in a reference plane (Abstract). The reference plane is formed by a metal parallelepiped 4, with a top face 40 that serves as the reference face (col. 2, lines 61-65; Fig. 2):



Positioning dowels 51, 52, 53 are arranged on the reference face 40 (col. 2, lines 66-67; Fig. 2), whereby one or more transmission optical fibers 2 rest on the face 40 abutting the three dowels 51-53 (col. 3, lines 14-16). A coupling optical fiber 3 is also mounted on the face 40 perpendicular to, and abutting up against the flat aperture 20 of, transmission optical fiber 2 (col. 3, lines 25-31). Positioning dowels 54-55 are used to position coupling optical fiber 3 in place. By using dowels 51-55, the orientation of the optical fibers 2/3 can be achieved without the need for machining positioning grooves, and it provides better definition of the plane upon which the optical fibers are resting (col. 1, lines 64-68). Adhesive is used to permanently secure the optical fibers 2/3 to the face 40 once proper positioning has been achieved using dowels 51-55 (col. 3, lines 46-55). Where the coupling and transmission optical fibers 2/3 have the same diameter, the axes of these fibers are precisely aligned to each other (col. 3, lines 60-64). If the transmission optical fiber 2 has a larger diameter than the coupling optical fiber 3, then shims 31 and 32 can be used to position optical fiber 3 above face 40 to align the optical fibers in a coplanar manner (col. 4, lines 5-17; Fig. 3). d'Auria does not teach or suggest any adhesive used to secure transmission fibers 2 to coupling fiber 3.

Dakss teaches a method of mounting a microsphere bead coupling lens 11 on to the end of an optical fiber 21 (col. 1, lines 7-10; Fig. 1). The optical fiber end 22 is dipped into an adhesive, and then the adhesive dipped end 23 of fiber 21 is lowered so the adhesive contacts the bead 24 (col. 3, lines 12-20; Figs. 3-5):



The adhesive holds onto bead 24 by surface tension as the fiber 21 is moved upwards. The combination of surface tension and gravity moves the bead lens 24 very close to the axis of the fiber 21 (col. 3, lines 21-28; Fig. 7).

Comerford teaches a support structure for a laser package having a plurality of discrete electrodes 20a-20m that segment the wafer into a plurality of individually controllable junction lasers (col. 2, lines 33-40). A cylindrical lens 14 is used to focus the laser output into a fiber optic waveguide 12a-12m (col. 3, lines 25-28; Fig. 1).

Scifres teaches diode lasers or diode laser bars 12/13 emitting a light beam 25 that is eventually focused into the end 31 of a solid state laser medium 33 (col. 3, line 64 to col. 4, line 12; Fig. 1).

The References Relied Upon By the Examiner Do Not Render the Claimed Invention Obvious

To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974); MPEP 2143.03. Further, there must be something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination. Lindemann Maschinenfabrik GmbH v. American Hoist and Derrick Co., 730 F.2d 1452, 1462, 221 U.S.P.Q. 481, 488 (Fed. Cir. 1984). Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988); MPEP 2143.01.

Claims 10, 15 and 19

The combination of the cited references fails to teach or suggest all the claimed elements. Specifically, independent claims 10, 15, and 19 all recite a laser diode module or light source with optical fibers that are mounted on a holder so that the light entrance sides thereof form a linear array. A cylindrical lens (second optical fiber) having at least the length of the linear array is attached directly to the light entrance side of each of the optical fibers using a bead of glue in a manner to center the lens on the light entrance sides (or ends) "**independent of the holder**" or "**to facilitate alignment independent of the holder**".

The Examiner relies on the patents to d'Auria, Comerford and Scifres to show the basic components of the claimed structure. d'Auria, the primary reference relied upon by the Examiner, teaches the alignment of a cylindrical fiber lens to the input ends of an array of transport fibers using a flat reference plane and positioning dowels, and then gluing the lens and fibers to the reference plane to ensure alignment therebetween. d'Auria fails to teach using beads of glue in the manner recited in the claims to attach and align the lens to

the transport fibers independent of the holder to which the transport fibers are mounted. In fact, on page 3 of the final office action, the Examiner admits that:

> Auria et al further fails to disclose the attaching of the cylindrical fiber lens to each of the optical fibers and method step of gluing the cylindrical lens onto the linear array of light entrance sides of the optical fibers.[1]

The Examiner concludes, however, that it would have been obvious to use the gluing technique of Dakss with the apparatus of d'Auria to attach the cylindrical fiber lens to each of the transmission optical fibers. The Applicant respectfully traverses this rejection.

> There is no suggestion or motivation for the combination suggested by the Examiner.

The prior art simply fails to provide any suggestion or motivation to modify the d'Auria device as suggested by the Examiner. The stated purpose in d'Auria is to provide a flat reference face to which the elements are attached. By either mounting the optical fibers directly onto the reference face, or on shims mounted onto the reference face, a reliable alignment therebetween is achieved. Adding the gluing step of Dakss does not address any apparent deficiency of the d'Auria device, or serve any other apparent purpose. Therefore, there would be no motivation in making the combination.

The Examiner also fails to specify exactly how the Dakss technique can be applied to the d'Auria device to render the claims obvious. However, once such details are considered, such as the order in which the combined steps are performed, other problems with the combination suggested by the Examiner become evident. For example, if the Dakss gluing step is performed before the lens and fibers are placed on the reference plane, then the reference plane and the dowels protruding therefrom would not be useable to align the elements together. This defeats the entire purpose of d'Auria, which is impermissible in

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[1] On page 6 of the final office action, the Examiner states that "d'Auria teaches attaching a single optical fiber lens to plurality of transmission fibers." To the extent the Examiner relies on this finding to support the final rejection, the Applicant respectfully traverses this statement. d'Auria teaches gluing the single optical fiber lens to the reference plane, and moving up the transmission fiber along the same reference plane "until it abuts against the coupling fiber 3 and is then stuck to the substrate" by glue itself. (col. 3, lines 46-59). It is submitted that the lens is not "attached" to the transmission fibers as the Examiner's statement suggests.

an obviousness rejection. A primary reference may not be modified in light of or combined with one or more secondary references where the result would be to render the primary reference inoperable for its intended purpose. In re Gordon, 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984). The intended purpose of d'Auria is to allow the reference plane and dowels to dictate the alignment of the fibers and lens, which is defeated if the lens and fibers are glued together first. Moreover, the Examiner fails to identify any teaching or suggestion on how one would properly align the transmission fibers relative to themselves and to the lens during the gluing step, especially in a manner that would allow the fibers and lens to thereafter be placed on the reference plane between the corresponding dowels.

If the Dakss gluing step is performed after the lens and fibers are placed on the reference face, then the gluing step serves no purpose because the lens and fibers are already aligned to each other by the reference face, dowels, and shims. If the gluing step serves no purpose, then certainly there would be no suggestion or motivation for adding it to the d'Auria device. Under section 103, teachings of references can be combined only if there is some suggestion or incentive to do so." ACS Hosp. Systems, Inc. v. Montefiore Hosp., 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984). In fact, if one tried to also glue the lens to the fibers, the system would be stressed since the fiber lens would be glued to two different elements. One skilled in the art would not choose that approach. Furthermore, the gluing step would not self align the lens to the fibers "independent of the holder" as recited by the claims, since the fibers and lens of d'Auria are already aligned by the reference face. Thus, not only is there no motivation to gluing the lens to the transport fibers after they are placed onto the reference face, but this combination also fails to satisfy the claimed elements of the invention which require the lens be independent of the holder.

The d'Auria and Dakss references teach away from each other

Plainly the d'Auria device is incompatible with the Dakss gluing technique. The whole premise of the d'Auria device is that a reference face and dowels mechanically secure the lens and fibers in position before they are glued

to the reference face. This clearly teaches away from any need for, or any use of, a gluing technique that must allow the elements to move relative to each other while they are being glued together.[2] It is improper to combine references where the references **teach away** from their combination. In re Grasselli, 713 F.2d 731, 218 USPQ 769, 779 (Fed. Cir. 1983); MPEP 2145.

There is no teaching or suggestion that the Dakss technique can be used to attach a lens to a plurality of optical fibers

The Dakss patent relates to the attachment of individual microspheres to individual fibers. There is no hint or suggestion that this method could be applied to simultaneously attaching a single elongated fiber lens to multiple transport fibers.

The method in Dakss is directed very specifically to single fibers and single lenses. As show in Figures 2-8 therein, a bead of glue is added to the end of the fiber. The fiber is then lowered into contact with a single spherical ball. The glue causes the lens to adhere to the fiber. The fiber is then raised and the glue is cured with a light source.

The approach described in Dakss could not be used to attach a cylindrical lens to multiple fibers simultaneously. More specifically, Dakss has no teaching whatsoever as to how one might line up all the transport fibers and mate them in an aligned fashion with an elongated fiber lens. As the Dakss patent is the only reference relied upon by the Examiner related to the concept of gluing a lens to a fiber, this glaring deficiency should be enough to defeat the obviousness argument.

The Applicant respectfully traverses the motivations stated by the Examiner

On page 4 of the final office action, the Examiner gives the following motivation for combining the Dakss technique with the d'Auria device: "...for

[2] On page 6 of the final office action, the Examiner points out that d'Auria teaches with respect to Fig. 6 that it is possible to discard the position means (dowels) for the coupling fiber lens on the substrate (holder). While this is true, that embodiment still relies on abutting the lens against a block 6 to mechanically hold the lens in place (col. 4, lines 68; Fig. 6).

the purpose of advantageously properly collimating laser radiation from the laser diode array and avoiding the problem of mis-alignment." Yet, the lens and optical fibers of d'Auria are already properly aligned to collimate the laser radiation from the laser diode array. That is the stated purpose and achievement of the reference face, dowels and shims. Once the alignment is achieved, the lens and fibers are glued to the reference face, thus already avoiding the problem of mis-alignment. Adding the Dakss gluing technique to the d'Auria device offers no apparent improvement to collimate the laser radiation or avoid misalignment. In fact, adding glue in this manner would stress the fibers and lens. Therefore, the Applicant respectfully submits that the motivation stated by the Examiner would not exist.

On page 7 of the final office action, the Examiner adds another motivation: reducing the cost of the device. However, no such cost reductions are evident from the stated combination. Adding the Dakss gluing technique to the d'Auria device would only add to the device's cost. No where does the Examiner indicate any steps that the prior art teaches or suggests could be eliminated by such a combination of references. There simply is no apparent cost savings to support the Examiner's claim that one would be motivated to reduce costs.

It appears that the only reason these references are combined is to meet the claimed elements of the Applicant's invention. However, obviousness may not be established using hindsight or in view of the teachings or suggestions of the inventor. Para-Ordnance Mfg., Inc. v. SGS Importers Int'l., Inc., 73 F.3d 1085, 1087, 37 USPQ2d 1237, 1239 (Fed. Cir. 1995), cert. denied, 117 S.Ct. 80 (1996).

For claims 19-21, Scifres was added by the Examiner as a basis for the rejection. However, Scifres fails to remedy any of the shortcomings of the d'Auria, Comerford, and Dakss references as described above.

Conclusion

The mere fact that a worker in the art could rearrange the parts of the reference device to meet the terms of the claims is not by itself sufficient to support a finding of obviousness. The prior art must provide a motivation or reason for the worker in the art, without the benefit of the applicant's specification, to make the necessary changes in the reference device. Ex parte Chicago Rawhide Manufacturing Co., 223 U.S.P.Q. 351 (Bd. Pat. App. & Inter. 1984); MPEP §2144.04.

It is respectfully submitted that without Applicant's specification, there is no motivation or reason in the prior art to modify the d'Auria device as suggested by the Examiner. Therefore, for the reasons set forth above, Applicant respectfully submits that claims 10, 15 and 19 (and claims 12, 14, 16-18 and 20-21 dependent thereon) are not rendered obvious by the cited prior art, and a holding to that end by the Board is respectfully requested.

Respectfully submitted,

LIMBACH & LIMBACH L.L.P.

Dated: June 8, 2000 By: Alan A. Limbach

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APPENDIX

10. (amended) In a laser diode module wherein laser radiation from a linear laser diode array is coupled into a plurality of optical fibers corresponding in number to the number of laser diodes in the laser diode array, each of the optical fibers having a light entrance side, the invention characterized in that:

the optical fibers are mounted on a holder and arranged so that the light entrance sides thereof form a linear array;

a cylindrical lens having at least the length of the linear laser diode array, said cylindrical lens being attached directly to the light entrance side of each of the optical fibers using a bead of glue in a manner to self center and align the cylindrical lens with respect to the light entrance sides independent of the holder; and

said linear array of light entrance sides of the optical fibers and said cylindrical lens glued thereon is aligned with the linear array of laser diodes for receiving radiation emitted therefrom and focussing said received radiation into said plurality of optical fibers.

12. (amended) The laser diode module claim 10, the invention further characterized in that said cylindrical lens is a length of optical fiber.

14. (amended) The laser diode module claim 10, the invention further characterized in that said bead of glue is an epoxy adhesive.

15. (amended) In a laser diode module wherein laser radiation from a linear laser diode array is coupled into a plurality of first optical fibers corresponding in number to the number of laser diodes in the laser diode array, each of the first optical fibers having a core diameter and a light entrance side, the invention characterized in that:

the first optical fibers are mounted on a holder and arranged so that the light entrance sides thereof form a linear array;

a second optical fiber having at least the length of the linear laser diode array, said second optical fiber being attached directly to the

entrance side of each of the first optical fibers using a bead of glue and centered thereon independent of the holder; and

said linear array of light entrance sides of the first optical fibers and said second optical fiber glued and centered thereon is aligned with the linear array of laser diodes for receiving radiation emitted therefrom and focussing said received radiation into said plurality of first optical fibers.

16. The laser diode module claim 15, the invention further characterized in that said first optical fibers are multimode optical fibers.

17. The laser diode module claim 16, the invention further characterized in that said second optical fiber has a diameter less than the core diameter of the first optical fibers.

18. The laser diode module claim 17, the invention further characterized in that said gluing is by means of an epoxy adhesive.

19. A light source for optically pumping a gain medium comprising:

a semiconductor laser structure having an array of emitter regions;

a plurality of optical fibers for carrying light emitted from the laser structure to a gain medium with the light entrance ends of the fibers being mounted on a holder and configured in a linear array spaced from the array of emitter regions of the laser structure; and

a single cylindrical lens for coupling the light from the emitter regions into the light entrance ends of the fiber, said lens having a length at least as long as the array of light entrance ends, said cylindrical lens being attached directly to each of the light entrance ends by a bead of glue in a manner to center the lens on the light entrance ends to facilitate alignment independent of the holder.

20. A light source as recited in claim 19 wherein said cylindrical lens is an optical fiber.

21. A light source as recited in claim 19 wherein said optical fibers are multimode fibers.